

WHAT IS CLAIMED IS:

1. A reproducing sensor comprising:
a multi-layer construction having;
a first MR element comprising a first ferromagnetic (pin), a second ferromagnetic layer (free) and a non-magnetic insulting layer formed between the first ferromagnetic layer and the second ferromagnetic layer,
a second MR element comprising a third ferromagnetic layer (free), a fourth ferromagnetic layer (pin) and non-magnetic insulting layer formed between the first ferromagnetic and the second ferromagnetic layer, and
a non-magnetic conductive layer formed between the second ferromagnetic layer (free) and the third ferromagnetic layer (free),
wherein a resistance of the first MR element and the second MR element is changed reversely from the magnetic field in the same direction,
magnetization directions of the first ferromagnetic layer and the fourth ferromagnetic layer are arranged in antiparallel with each other,
a pair of electrodes for flowing an electric current in the direction perpendicular to the film surface of the multi-layer construction, and
a pair of shield inserting the multi-layer construction,
wherein the first MR element and the second MR element are electrically connected in series through the non-magnetic conductive layer by passing current between the pair of electrodes, and are patterned together with almost the same width.
2. A reproducing sensor comprising according to claim 1, wherein magnetization directions of the second ferromagnetic layer and the third ferromagnetic layer are arranged in parallel with each other.
3. A reproducing sensor comprising according to claim 1, wherein a medium opposed surface of the pair of shield and a medium opposed surface of the multi-layer construction hold a same surface.
4. A reproducing sensor according to claim 1,

wherein the first MR element comprises a first antiferromagnetic layer for fixing the magnetization direction of the first ferromagnetic layer,

wherein the second MR element comprises a second antiferromagnetic layer for fixing the magnetization direction of the fourth ferromagnetic layer.

5. A reproducing sensor according to claim 1,
wherein the first MR element and the second MR element are prevented from being shifted in the track width direction.
6. The reproducing sensor according to claim 1, wherein electric resistances said MR elements changes during a reproducing operation, one of the electric resistances is increased to a medium magnetic field in the same direction, and the other is decreased thereto.
7. The reproducing sensor according to claim 1, wherein at least one of the first ferromagnetic layer and the fourth ferromagnetic layer is of a three-layer construction of ferromagnetic material thin film/non-magnetic metal thin film/ferromagnetic material thin film, and magnetizations of the ferromagnetic material thin film forming both ends of the three-layer construction are coupled so as to be arranged in antiparallel with each other.
8. The reproducing sensor according to claim 7, wherein the non-magnetic metal thin film in said at least one of the first ferromagnetic layer and the fourth ferromagnetic layer in said pair of magnetoresistive layers is any one of Ru, Rh and Ir.
9. The reproducing sensor according to claim 1, wherein at least one of the ferromagnetic layers of said MR elements reverses a fixing direction of magnetization thereof by applying a predetermined magnetic field.
10. The reproducing sensor according to claim 1, wherein said MR elements included at least one spin tunnel junction.

11. The reproducing sensor according to claim 10, wherein the non-magnetic insulating layers in said MR elements are made of oxide aluminum.